TARGETED IN-SITU REMEDIATION TO PROVIDE A SUSTAINABLE REMEDIATION STRATEGY FOR A DENSE URBAN UNDERGROUND STORAGE TANK SITE

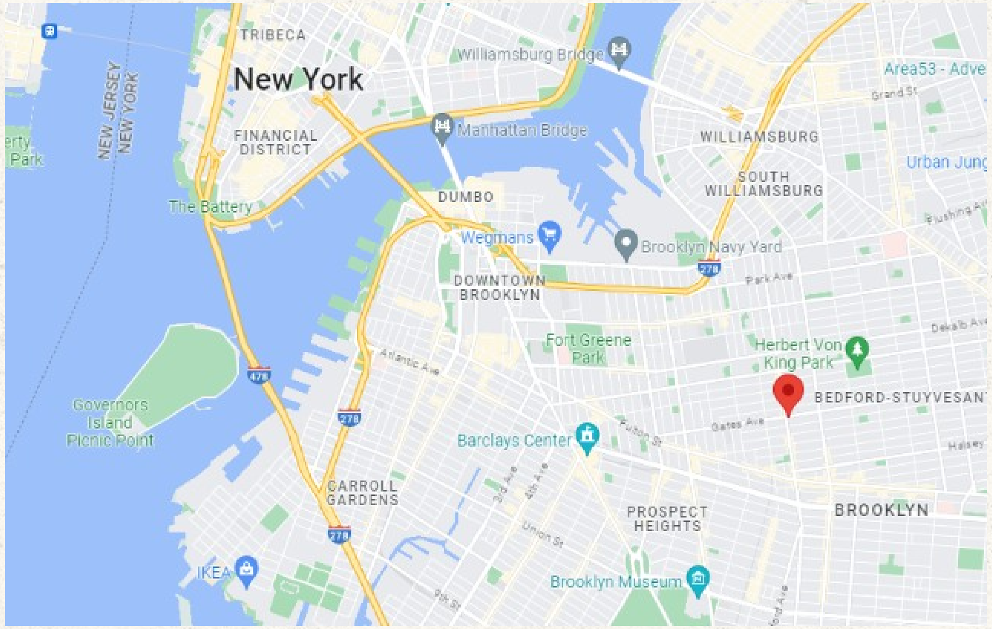
Mike Mazzarese

Senior Remediation Engineer, AST Environmental, Inc.

Denver, CO, USA

Project Snapshot

- Former petroleum station in dense urban setting (NYC)
- Treatment Area = ~400 m^2
- Lithology = Fine to medium sand with some gravel, silt, and cobbles
- Depth to Water = ~14 m below ground surface (bgs)
- Treatment Interval = 12.8 to 18 m bgs
- Contaminant(s) = Toluene, Ethylbenzene, and Xylenes (goal = 5 ppb), **Benzene ND**
- Implementation Method = Pre-Drill (GeoTAP)/DPT Injection

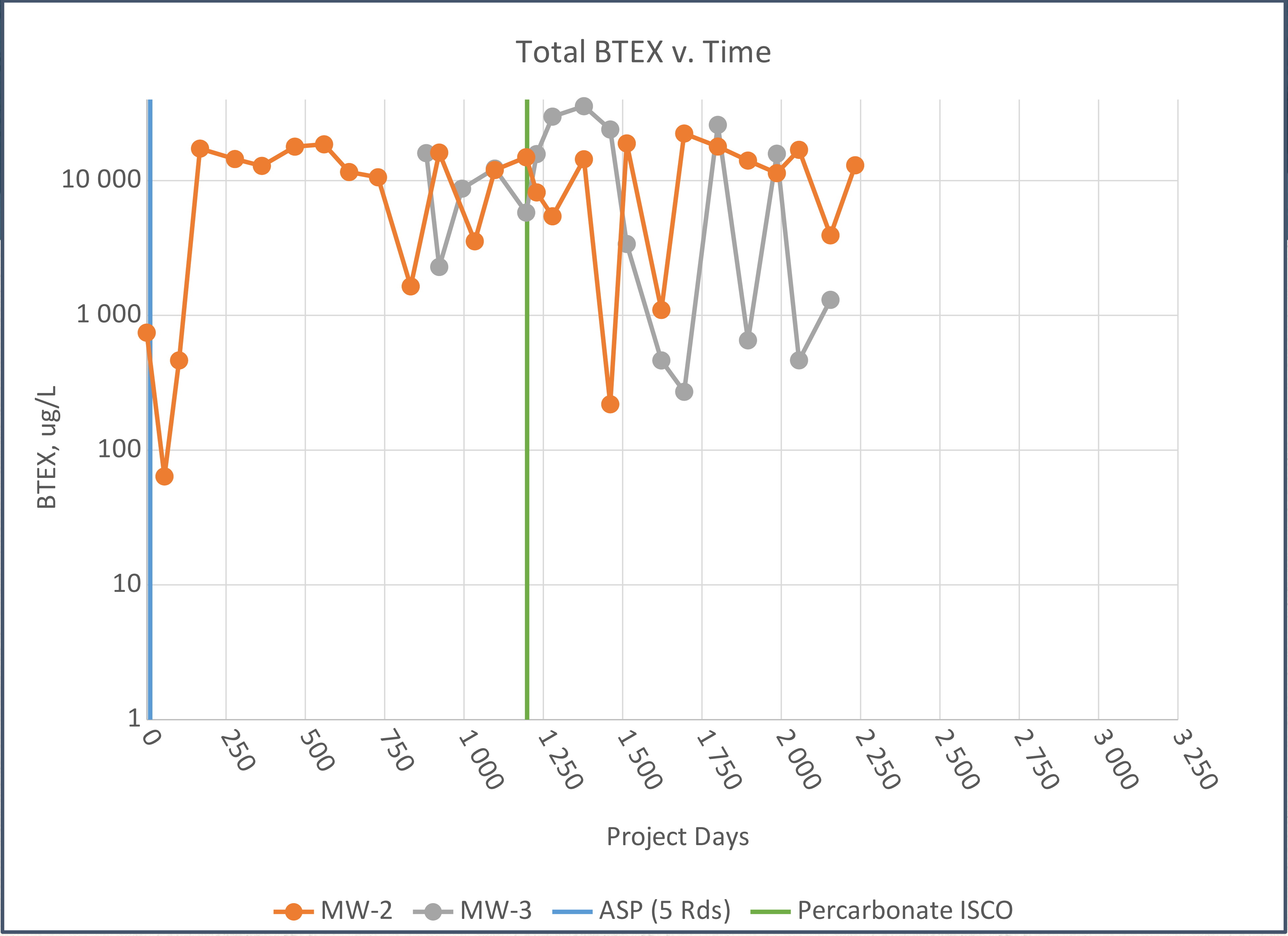


Project Snapshot

- MiHPT and high-density sampling were used to refine the conceptual site model (CSM) and to optimize the remedial design
- A technology was needed that could remediate the mass onsite but also manage mass from migrating back onsite from under the road
- Activated carbon-based technology was applied after In Situ Chemical Oxidation (ISCO) was attempted at the site multiple (6) times

Chronology

- 1991 USTs removed/excavation
- 2007 ISCO pilot testing and limited excavation
- 2009 Sodium persulfate, hydrogen peroxide and ozone (5 injection events)
- 2009 Limited excavation work
- 2012 RegenOx injection



Total BTEX v. Time
BTEX, ug/L
10 000
1 000
100
10
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750
1 000
1 250
1 500
1 750
2 000
2 250
2 500
2 750
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3 250
Project Days
MW-2
MW-3
ASP (5 Rds)
Percarbonate ISCO

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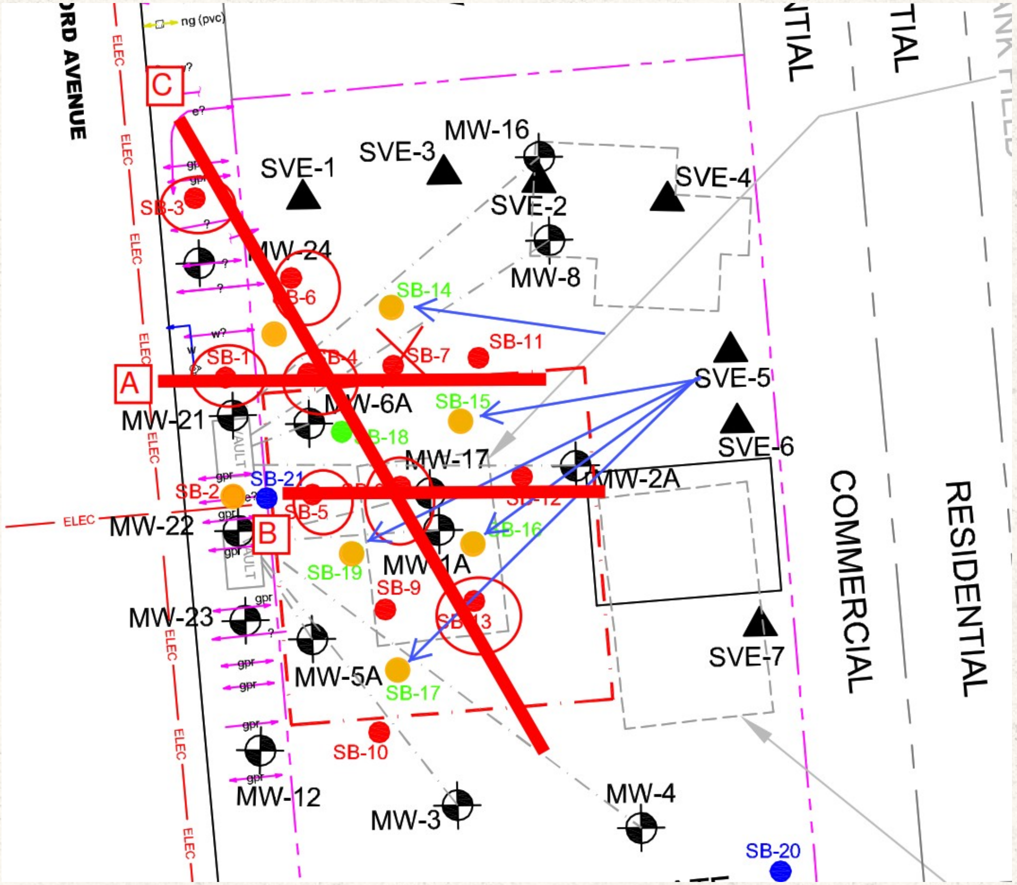
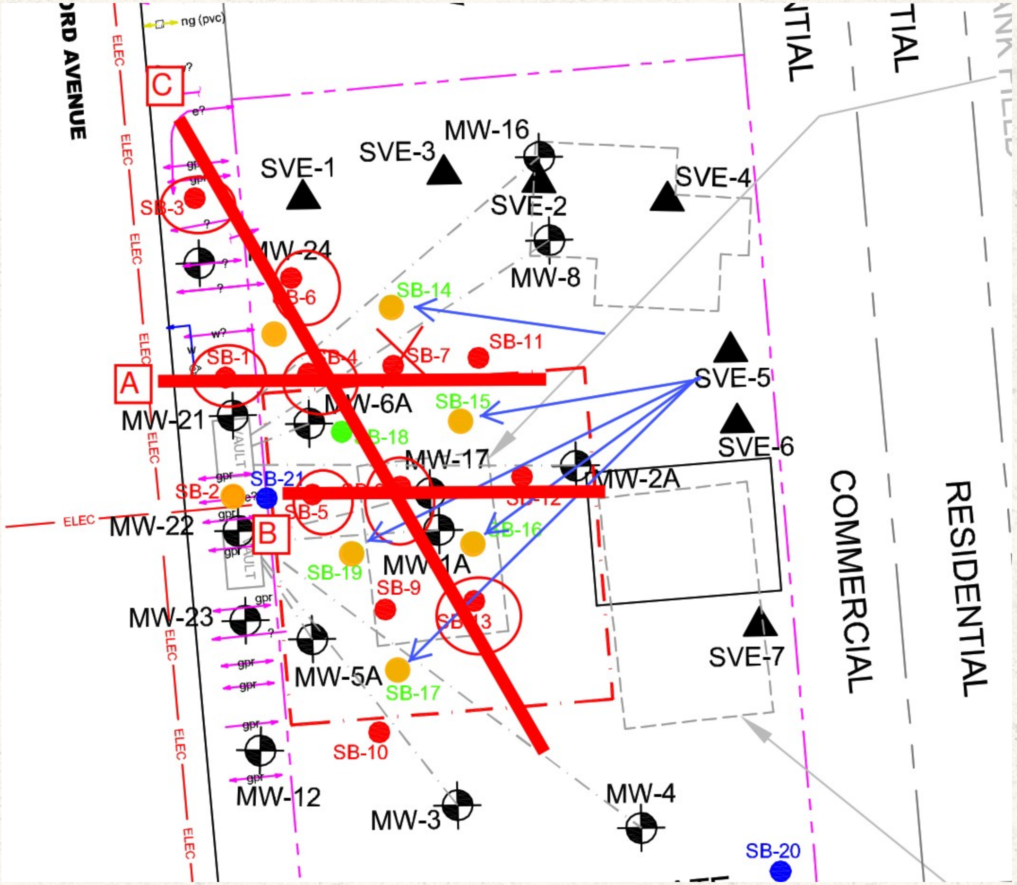
- **2014 HRSC survey/RDC sampling**

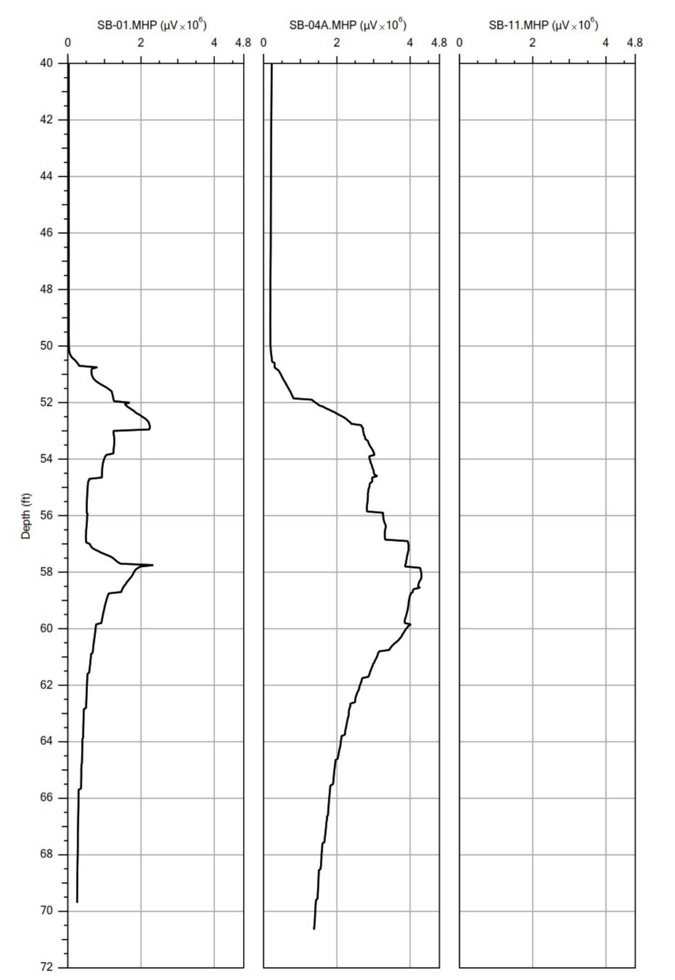
MiHPT Results



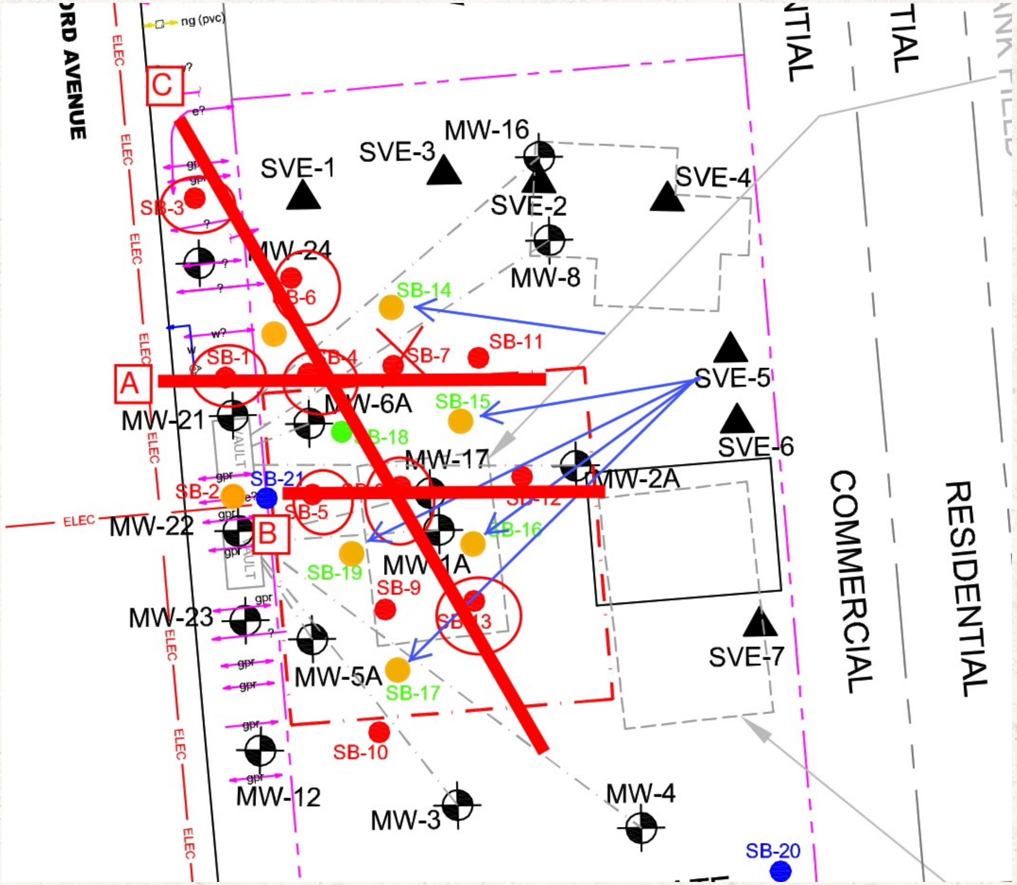
MiHPT ID	Total Depth	PID Depth Range	Max PID	Closest MW	BTEX
	(m)	(ft-ft)	(uV)		(ppb)
SB-01	21.3	15.2-21.3	2.35e6	MW-21	271
SB-03	21.6	17.7-21.6	1.1e6	MW-24	3,454
SB-4A	21.6	15.2-21.3	4.3e6	MW-6A	22,353
SB-05	21.3	14.9-21.3	3.0e6	MW-22	14,783
SB-06	21.6	16.2-21.6	6.5e6	MW-24	3,454
SB-08	21.9	11.6-22.0	4.2e5	MW-1A	242

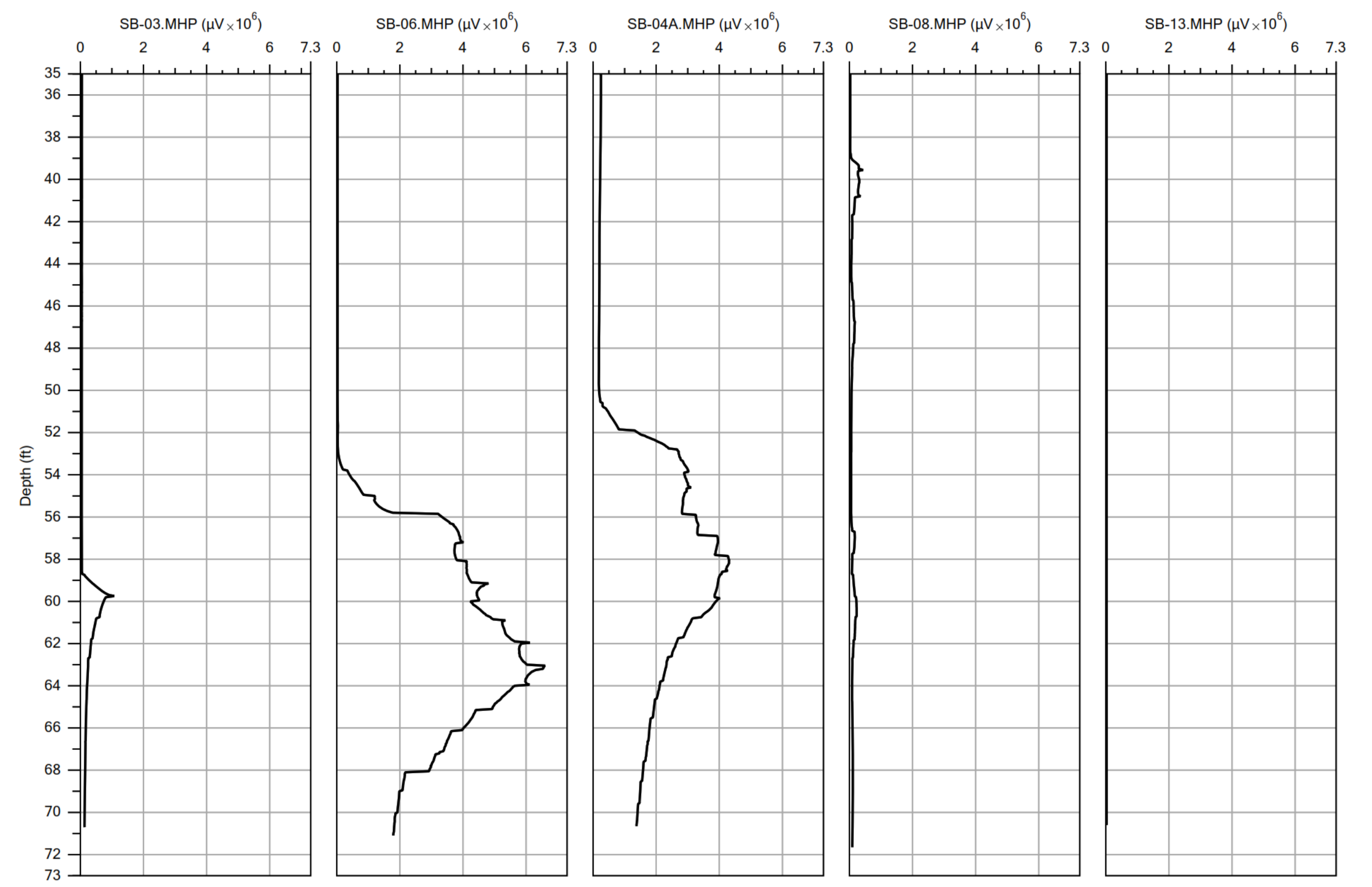
MiHPT Results





MiHPT Results





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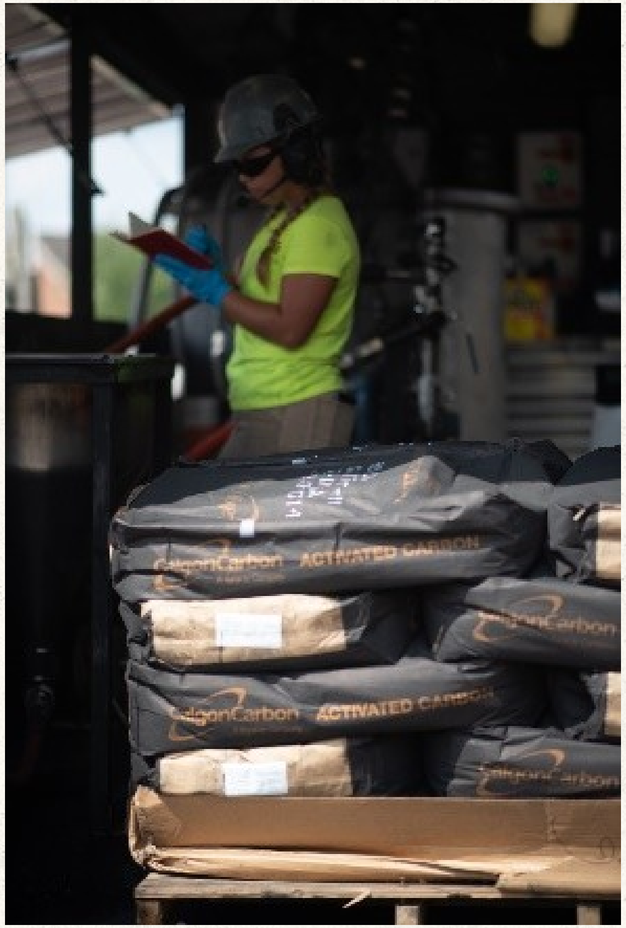
- 2014 HRSC survey/RDC sampling
- **2015 BOS 200 injection**

Pre-Drill Technique (GeoTAP)

- Traditional direct push technology (DPT) could not consistently penetrate a gravel layer that extended to approximately 12 m bgs.
- Used on sites where DPT (alone) cannot be used due to refusal
  - e.g. Glacial till, weathered bedrock, historic fill, etc.
- Pre-drill using augers or sonic* to total depth, backfill with hydrated bentonite, and then re-drill through bentonite using DPT.
- Injection slurry* cuts though bentonite and into formation.
- 50+ sites in various geologies completed to date in Europe, USA, Canada, and Australia.

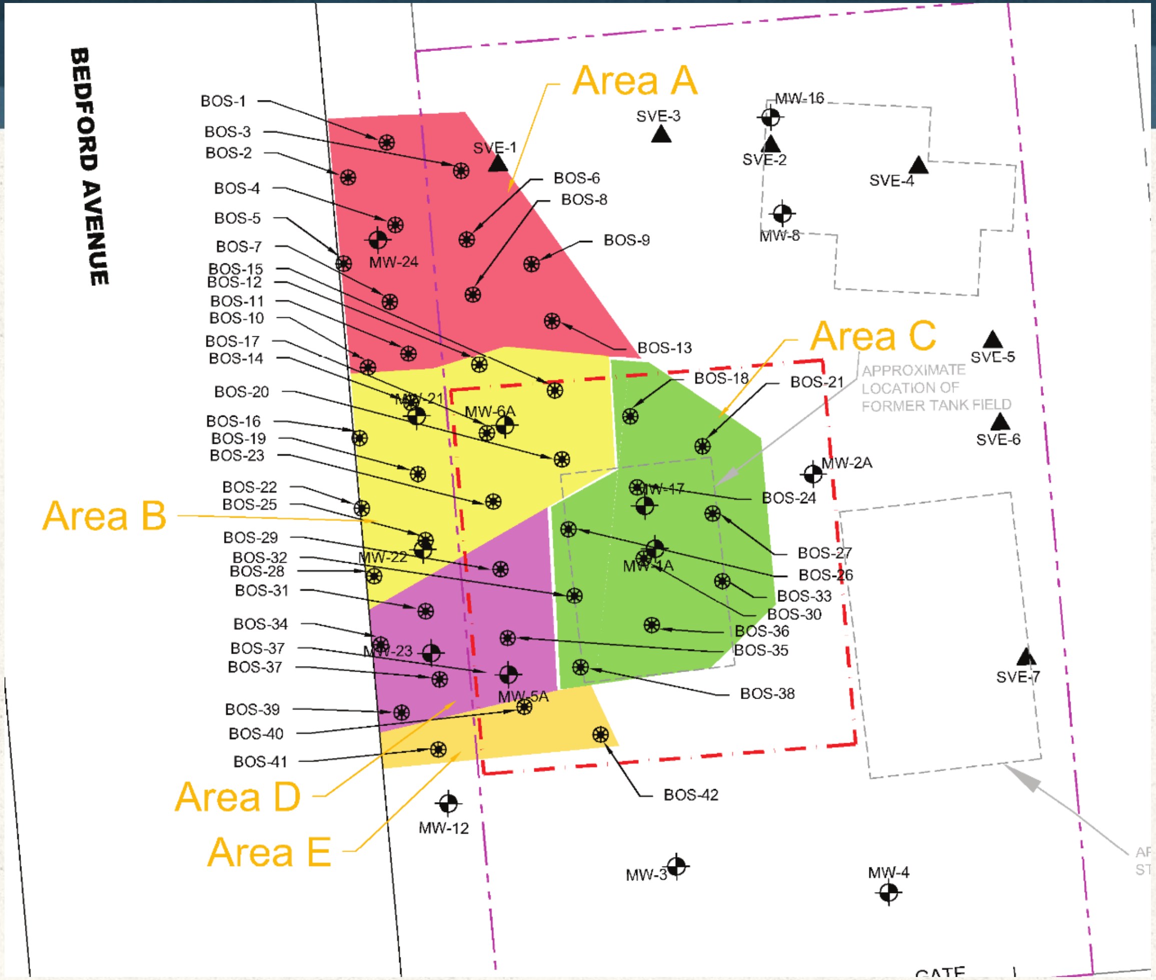
BOS 200® Technology

- Primarily used to treat petroleum hydrocarbons
- BOS 200® consists of:
  - Activated Carbon (Powdered)
  - Terminal electron acceptors (nitrate and sulfate)
  - Micro and macro nutrients
  - Consortium of facultative hydrocarbon degraders
- Slurry applied in typically 6-36% w/w
- Additional CaSO4 can be added to provide long-term TEA



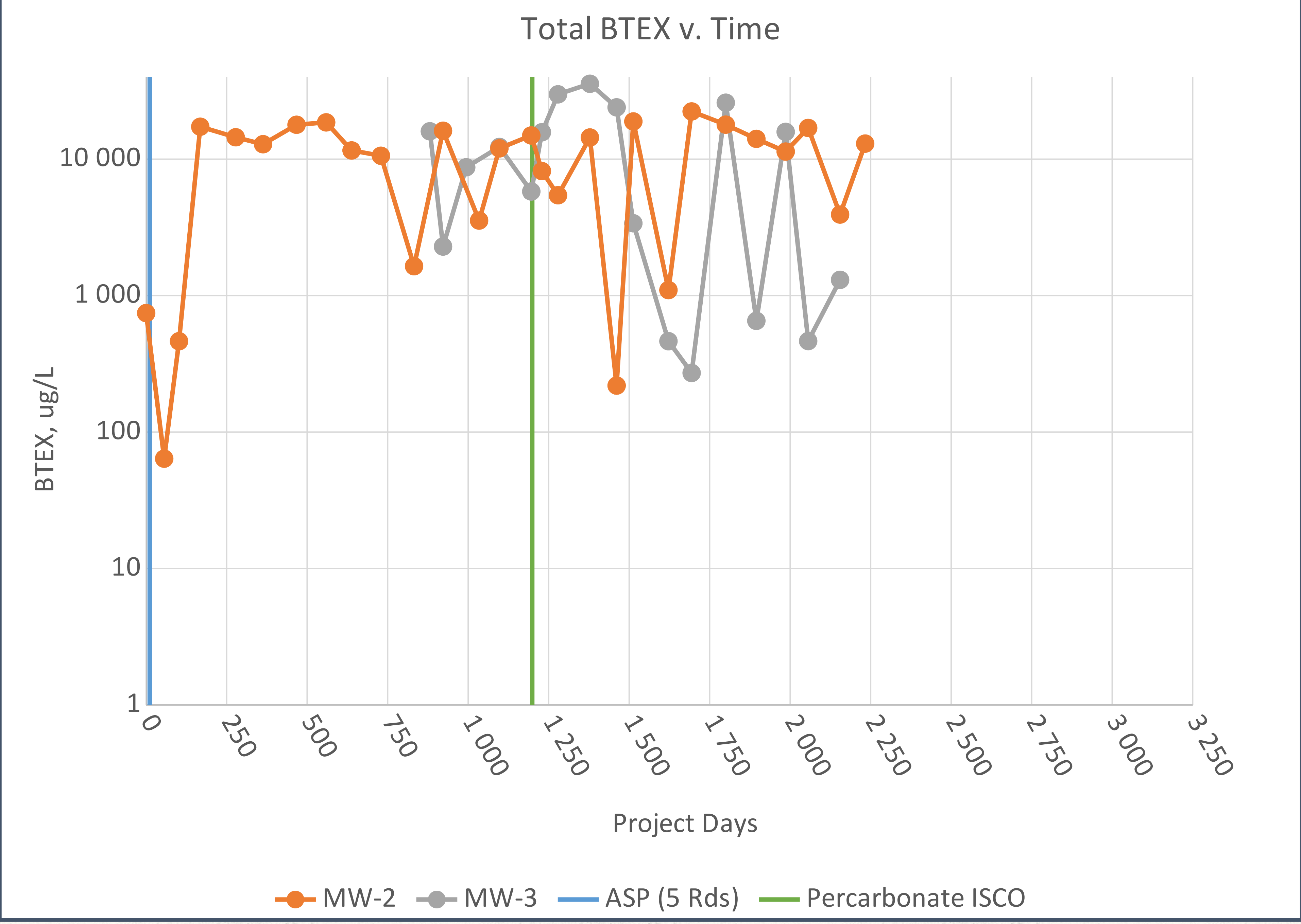
Injection Design

- BOS 200® slurry was applied within an approximate 400 m² area through 42 pre-drill injection locations (approximate 3 m spacing)
- Using MiHPT and sampling data, 5 treatment areas were identified
- Injection flow rates of 280 to 380 lpm
- Injection pressure of 14-20 bar (subtracting system/tooling losses)



Results

- The maximum baseline concentrations for the target contaminants were 34 ug/l, 5,710 ug/l, and 7,250 ug/l for Toluene, Ethylbenzene, and Total Xylenes respectively
- Four (4) of the five (5) monitoring wells within the treatment footprint achieved the project objective of 5 ug/l for Toluene, Ethylbenzene, and Total Xylenes. The fifth well achieved approximately 50% reductions for the target contaminants of concern



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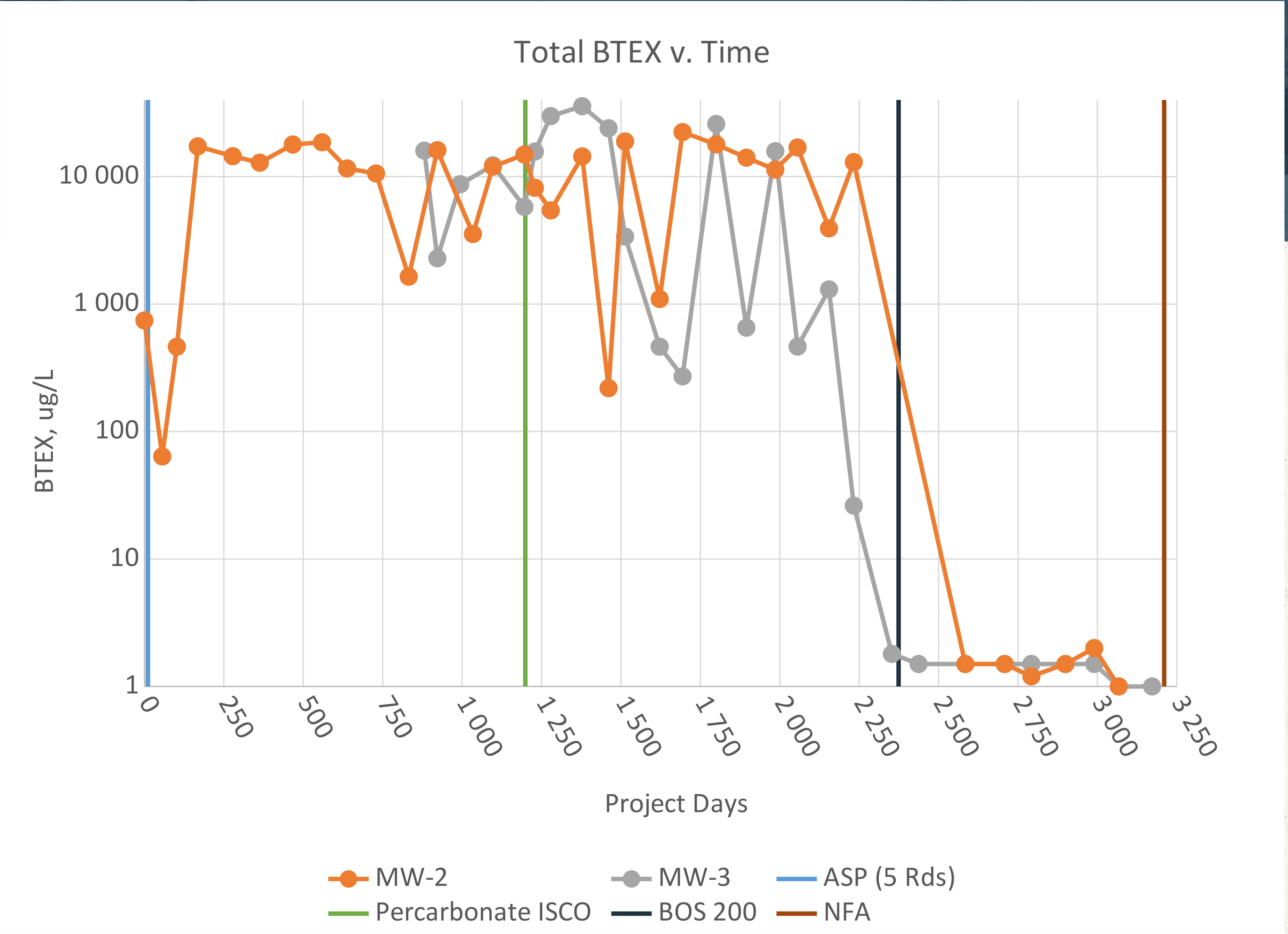

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Percarbonate ISCO
BOS 200
NFA

Chronology

- 1991 USTs removed/excavation
- 2007 ISCO pilot testing and limited excavation
- 2009 (6 mo) 7,400 gal sodium persulfate + 46,000 gal hydrogen peroxide + 21 lbs ozone (5 injection events)
- 2009 Limited excavation work
- 2012 9,000 gal RegenOx injection
- 2014 HRSC survey/RDC sampling
- 2015 BOS 200 injection
- **2018 NFA**

Photos


BEDFORD BEER DIST.
BEER - SODA - DRINKS


Bedford Av
WHISPERWATT
70
1-800-No Sweat
SUNBELT
1-800-No Sweat

Results

- A No Further Action (NFA) was issued, and the property has since been converted from a vacant lot to six story mixed commercial/residential building.

Thank you for your time!

mmazzarese@astenv.com

astenv.com